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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 102086/RP/ABS	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/02028	International filing date (day/month/year) 26/05/2000	Priority date (day/month/year) 01/06/1999
International Patent Classification (IPC) or national classification and IPC G02B6/132		
Applicant BOOKHAM TECHNOLOGY PLC et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 06/11/2000	Date of completion of this report 08.02.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Lerbinger, K Telephone No. +49 89 2399 2274



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02028

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

Description, pages:

1-10 as originally filed

Claims, No.:

1-30 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

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☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-30
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-30
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-30
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Item V

1 Claim 1

- 1.1 Document US 5,673,284 describes (cf. figure 4b) a junction structure comprising:
- a light transmitting semiconductor layer (InGaAsP layer) having an end face at the junction (see the figure),
 - a substrate (silicon substrate) below the semiconductor layer and extending beyond the junction (see the figure),
 - a first dielectric light transmitting layer (phosphorus doped silicon dioxide (PSG) core waveguide 458) formed over the extending part of the substrate and extending in alignment with the semiconductor layer to provide a further waveguide region (see the figure),
 - and a second dielectric layer (SiO₂ layer) of refractive index below that of the two waveguide regions is formed over the end face of the semiconductor and over the extending part of the substrate, thereby forming a support layer (see the figure).

The subject-matter of claim 1 therefore differs from this known structure in that the support layer does not have a thickness so as to provide an alignment of the optical axis through the two waveguide regions.

The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

- 1.2 In the above cited prior art structure the light propagating in the light transmitting semiconductor layer is coupled via a grating (see the figure; coupling grating 461) into the first dielectric light transmitting layer. Present claim 1 proposes a different junction structure which avoids the coupling grating: by carefully choosing the thickness of the second dielectric layer and the thickness of the first dielectric light transmitting layer a first dielectric light transmitting layer is formed whose centreline is exactly in line with the height of maximum light energy within the light transmitting semiconductor layer, so that the maximum light energy is at line throughout the junction.

Since none of the available prior art documents describes or hints at such a

junction structure, i.e. at a second dielectric layer which on the one hand which covers the end face of the semiconductor waveguide and at the other hand is a support layer of a required height, the solution proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT).

2 Independent claim 2

Since claim is basically identical to claim 1 including the further technical features that the first dielectric light transmitting layer is a silicon nitride layer, independent claim 2 is also new and involves an inventive step (Article 33 (2) and (3) PCT).

3 Dependent claims 2 to 13

Claims 2 to 13 are dependent on independent claims 1 and/or 2 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

4 Independent claim 14 and dependent claims 15 to 18

Independent claim 14 and dependent claims 15 to 18 all include a waveguide junction as defined in claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

5 Method claims 19 to 30

Since the method claims are either directed to a method of forming a junction structure (claims 19 to 27) including the essential new and inventive features of claim 1 or at a method of using the interferometer as defined claim 15 these claims also meet the requirements of the PCT with respect to novelty and inventive step.

6 Claims 1 to 30

As can be seen from the cited prior art the subject-matter of the claims also meets the requirements of industrial applicability (Article 33(4) PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02028

Item VII

- 1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents US5,673,284 is not mentioned in the description, nor is this document identified therein.
- 2 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Item VIII

- 1 The phrase "thereby forming a support layer of required thickness for the further waveguide region to provide the required alignment of the optical axis through the two waveguide regions" is considered vague since it does not unambiguously define that a silicon nitride waveguide with a centerline is formed exactly in line with the height of maximum light energy within the silicon waveguide so that the maximum light energy is at line throughout the junction (see for example page 7, first paragraph).

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 102086/RP	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/ 02028	International filing date (day/month/year) 26/05/2000	(Earliest) Priority Date (day/month/year) 01/06/1999
Applicant BOOKHAM TECHNOLOGY PLC et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

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☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/02028

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02B6/132

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 673 284 A (PANG LILY Y ET AL) 30 September 1997 (1997-09-30) abstract; figures 4B, 5A, 7F column 3, line 5 - line 18 ---	1-28
A	US 5 661 077 A (AHN JU-HEON ET AL) 26 August 1997 (1997-08-26) abstract; figures 1C, 2A column 2, line 27 - line 48 column 3, line 10 - line 23 ---	1-28
A	US 4 286 838 A (HUIGNARD JEAN-PIERRE ET AL) 1 September 1981 (1981-09-01) abstract; figures 1, 5 column 2, line 9 - line 33 column 4, line 7 - line 35 -----	1-28



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

21 August 2000

Date of mailing of the international search report

28/08/2000

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/02028

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5673284	A	30-09-1997	US	6064783 A	16-05-2000
US 5661077	A	26-08-1997	KR	155509 B	15-10-1998
			DE	4445566 A	05-06-1996
			JP	2742391 B	22-04-1998
			JP	8162625 A	21-06-1996
US 4286838	A	01-09-1981	FR	2426922 A	21-12-1979
			DE	2960086 D	12-03-1981
			EP	0006052 A	12-12-1979
			JP	54164146 A	27-12-1979